

1. Animals which were rendered ill by a direct application of toxic material either by drenching or by parenteral injection of toxic material.

2. Animals that were rendered ill by allowing them to partake of selected putrid material on their own accord.

3. Animals that contracted the disease (naturally) in the veld.

The animals of group two and three could be considered to have contracted the disease in an identical, viz., a natural manner, the only difference between the two being in the conditions under which the toxic material was found.

The animals of the second group found their toxic bones either in a trough or scattered in a paddock to which they had access once a day, the animals selected having previously been proved to be bone-eaters. The controls, on the other hand, found the toxic substances in the veld. When selected as controls they had no history of bone-eating. In the veld cases, the presence of osteophagia was noted in some animals that had been occasionally submitted to the bone-eating tests. In others again, on autopsy, bones and other foreign bodies were found in the reticulum, thus indicating that they had been subjects of osteophagia.

Generally speaking, the peracute and acute cases were most numerous in the animals that were drenched with toxic material or that were injected with large quantities of toxin. They were, however, not absent in the animals that contracted the disease by picking and eating toxic material, but were decidedly less numerous. These more often showed the symptoms and the course of a subacute and chronic disease, and recoveries occurred more frequently.

The symptoms that were observed and could be considered to be more or less pathognomonic for lamsiekte could be grouped as follows:

1. Absence of fever.
2. Paresis and paralysis of the locomotor system.
3. Paresis and paralysis of the masticatory and deglutitive organs.

In the greatest number of cases paresis and paralysis of the locomotor system were present, whilst more often those of the digestive system were absent. It would appear that in the acute disease of artificially produced cases these symptoms were more oftener present. Their presence in the absence of the former was a rare exception, and only definitely noted in one case. Paresis and paralysis of the locomotor system alone were mainly found in chronic cases, of which quite a number recovered. These animals, particularly those that recovered, were able to partake of food frequently during the whole period of the disease, and thus they were able to maintain their condition. In the chronic cases that ended fatally, paresis and paralysis of the masticatory and deglutitive system were usually absent.

The difference in symptomatology between the artificially and naturally contracted disease was only one of degree. The drenched or injected animals in most cases received more toxic substance than the minimal lethal dose, and hence a peracute or acute disease was the result. This interpretation found a further support in the fact that the acute cases in the greatest number of instances showed

a short incubation period as well. In some animals that were drenched this period was longer than in those that were injected subcutaneously with toxin. In this case it never exceeded seven days, and was seven days in one case only. This difference might be due to the method of application, the toxin in the case of a putrid substance being liberated only after the latter had more or less been dissolved by digestion.

Comparing the symptomatology and course of the disease in the animals of the second and third groups, we found an almost identical course in both. There was a remarkable observation in one set of animals of the second group, viz., of those that picked the bones in a paddock. Some of these showed an unusually mild course, which would probably have escaped notice had not such close observations been made. Some of them showed such an unusual course of the disease that it might be called abnormal lamsiekte. Some importance might also be attached to the fact that whereas of the animals that contracted lamsiekte in the veld only one case recovered, of those that contracted the disease from bones supplied a great number recovered. This difference might possibly find an explanation by assuming that the putrid substances picked up in the veld were generally more toxic than those supplied. In this connexion it might be mentioned that soon after the aetiology of the disease had been cleared up the veld was regularly searched for carcasses of wild animals, and steenbucks, meercats, and tortoises were occasionally found. Therefore an opportunity to pick up putrid material was occasionally offered to craving animals notwithstanding the systematic searching.

In comparing the symptoms and the course of the disease in the animals treated in the various ways with those in the animals that contracted it naturally, we found, taking all things into consideration, a remarkable conformity, and we had, therefore, no hesitation to consider the different groups of diseases as identical, representing one and the same aetiological unity, that due to a specific toxin produced in putrefying cadavers.

G.—SYMPTOMATOLOGY OF LAMSIEKTE IN GOATS THAT WERE DRENCHED WITH PYCNOSOMA LARVAE OR PUPAE.

Seven animals that were drenched with pycnosoma larvae or pupae came into consideration. Of these, four contracted lamsiekte, one died of the disease (12307), two were killed *in extremis* (12313, 12280), and one recovered (12278).

The disease in the animals that died or were killed *in extremis* was of an acute nature, lasting two days; in the animal that recovered it was chronic, lasting over nineteen days.

THE ACUTE DISEASE.

The incubation period in one case was two days (12280); in the other two cases it was four days (12307, 12313).

The animals when noted ill were lying down most of the time, rising only with difficulty, or when forced to do so, and when on their feet, walking with a stiff gait and with great difficulty. After rising, they soon went down again. They finally remained in sterno-costal position or went over into lateral position, being unable to maintain

the sterno-costal position when put into it. In one case salivation was present from the beginning; it increased during the subsequent time. Deglutition was apparently also impossible since on inspection a bolus was found in the mouth.

THE CHRONIC DISEASE.

The incubation period was eight days. The animal, when observed to be ill, was noted to lie down frequently; it was able to rise, but walked with great difficulty. This state of affairs did not change much in the course of the next nineteen days, on which day a marked improvement was noted, the animal finally recovering.

H.—SYMPTOMATOLOGY OF LAMSIEKTE IN GOATS THAT WERE INJECTED WITH TOXIN.

Fifty-eight cases occurring in fifty-four animals were considered. One of these recovered twice, but succumbed to the third injection (31); two recovered, succumbing to the second injection (24 and 30), whilst seven recovered, which were not injected for a second time (34, 77, 40, 60, 25, 35, 48). There were thus ten animals that recovered. The greatest number died or were killed *in extremis* (81, 41, 39), or died of shock whilst under treatment (49, 12).

The incubation period varied from one to seven days; the duration of the disease varied from a few hours in the shortest case to fifty-two days in the longest.

PERACUTE LAMSIEKTE.

There were twelve animals in this group. Of these, one was killed *in extremis* (81) and the others died. One of the animals had a previous recovery from the injection (30).

The incubation periods were as follows:—

One day in one case (6); one and a half day in four cases (8, 7, 4, 15); two days in two cases (14, 42); two and a half days in two cases (10, 33); three and a half days in one case (11); four and a half days in the one case in which the animal had recovered from a previous attack (30); and six and a half days in the case (81) in which the animal was killed *in extremis*.

Symptoms were not noted in all cases, the goats dying during the night after having shown a normal behaviour the previous night (4.10.30). All the goats in which the disease was diagnosed showed more or less the same symptoms during life. They were either found in sterno-costal or in sternal position (like a dog), being unable to rise or support the head in normal position; others were stretched out in lateral position. When put on to their feet most of them were unable to stand. Those that were able to stand when lifted soon went down again. Death occurred as a rule without agony. In one case only were symptoms noted that indicated a paralysis of the tongue; when it was forcibly drawn out of the mouth the goat had difficulty in drawing it back again.

ACUTE LAMSIEKTE.

Nineteen animals came into consideration in this group. Only one of these recovered (24); it subsequently died of acute lamsiekte when reinjected. All the others died. The incubation periods varied as follows:—

One day in one animal (1), the disease lasting one day; one and a half day in four animals (9, 5, 65, 45), duration of the disease being

one day; two days in six animals, in two of which the disease lasted one day (2, 51); in one, one and a half day (32); in three it lasted two days (19, 21, 18); two and a half days in three animals, the disease lasting one day (37, 29, 53); three days in two animals, in one that recovered (24) it lasted one day, in the other two days (17); three and a half days in one animal (28), the disease lasting one and a half day; four days in two animals (23, 46), the disease lasting two days; four and a half days in one animal (24) that recovered from the disease.

The following symptoms were recorded:—

Some goats were paralysed, the head and neck being stretched out on the ground. When lifted they were unable to stand, the neck was limp, the head doubling back on to the thorax.

In another case the animal was able to stand, and when lifted on to its feet it could walk a few steps, but then suddenly dropped into sterno-costal position. It was also noted that rising was difficult. In rising, the animal stumbled and appeared weak in the joints; it lay down immediately.

In still other cases the animals were noted to stand, but to lie down at frequent intervals, being able to rise voluntary or if forced to do so, but going down soon after rising.

In the course of the subsequent hours, the paresis increased; the goats that were still able to rise refused to do so; some remained down and died in sterno-costal position; others went over into lateral position and died. No agony was recorded.

Symptoms of disturbances in the digestive organs were not much in evidence.

Paralysis of the mandible was noted in one case, the mouth being kept open; in the same case paralysis of the deglutitive organ was also diagnosed, a bolus, which apparently could not be passed down, lying in front of the mouth.

The goat that recovered from lamsiekte was lying down when noted ill. It had some difficulty in rising. After twenty-four hours it showed great improvement and rose without difficulty. It recovered completely.

SUBACUTE LAMSIEKTE.

There were ten goats in this group. Three goats recovered, one of which (3) had previously recovered from a chronic attack of the disease; she made another recovery from a subacute attack, but finally died of another subacute attack. One (25) had previously recovered from a chronic attack of the disease. Two other cases (34, 77) were subsequently not tested. All the other goats died of the disease. The incubation period and duration of the disease were as follows:—

Two days' incubation in two cases, one of three days (3) and one of four days' duration (22), the former being the animal that had twice previously recovered from the disease; three days' incubation in two cases, one of three days' duration (27) and one of seven days' duration of illness (25). This animal had previously recovered from a chronic attack of the disease; three and a half days' incubation in three cases, two of three days' duration (43, 31), and one of four days' duration of illness (34); the latter animal recovered; five days' incubation in three animals, one (44) of four days' duration, one that recovered of six days' duration (3), and one of seven days' duration of illness (38); six and a half days' incubation in one case that had an illness of four days (77). It recovered.

The symptoms that were noted affected the locomotor system. The goats, when found ill, were in sterno-costal position and showed considerable difficulty in rising; some went down again.

In other cases the goats were lying in sterno-costal position, being unable to rise or stand when lifted on to their feet.

In still other instances they were lying in sterno-costal position, being unable to rise but able to stand when put on to their feet; they appeared weak and stiff, and either went down soon afterwards or walked a short distance before doing so.

Complete paralysis established itself in those cases that were still able to rise on the first or second days. Finally all the animals remained down in sterno-costal position or in lateral position, and died without any or hardly any agony.

There were no symptoms recorded affecting the masticatory or deglutitive organs.

In one case the goats that recovered were in sterno-costal position, and showed difficulty in rising when found ill. In the course of the next day they were unable to rise, but able to stand when lifted on to their feet. Afterwards they could again rise without assistance, an improvement that continued to complete recovery. In another case the goat was able to rise and walk, although with some difficulty. It lagged behind the herd, stopped from time to time to lie down, and then followed the herd again.

In a third case the goat only showed muscular weakness, which remained for a few days and then finally passed over.

CHRONIC LAMSIEKTE.

There were fifteen goats in this group. Seven recovered from the attack of lamsiekte (30, 3, 40, 60, 25, 35, 48); two were killed (41, 39); two died of shock under treatment (49, 12); and the rest died (36, 20, 13, 26).

The incubation periods and the duration of the disease were as follows:—

Two days in a case of fifteen days' duration of illness, the animal being killed *in extremis* (39); two and a half days in a case of thirty-two days' duration; this animal died (26); three days in a case of fourteen days' duration, the animal being killed *in extremis* (41); four days in a case of twenty-one days' duration (25), and four and a half days in a case of fifteen days' duration (30), both animals recovering; five days in six cases, one of eleven days' duration ending fatally, two of sixteen days' duration (3, 40) (both animals recovering), two of eighteen days' duration [one animal dying (20) and the other succumbing to shock (49)], and one case of fifty-two days' duration of illness, in which the animal recovered (48); six days in two cases, one of seventeen days' duration (60) and one of twenty-five days' duration (35), both animals recovering; seven days in two cases, one of twenty-four days' duration ending fatally (13) and one of fifty-one days' duration, animal succumbing to shock (12).

The symptom noted during the first few days of illness was an inability to rise, the animals lying in sterno-costal position. When lifted, the goat either walked about with a stiff gait or it went down rather more often than usual. Some goats went down and only rose when forced to do so; others again either had slight or considerable difficulty in rising. When put on to their feet some were able to walk.

In the course of the next few days these symptoms in almost all cases became aggravated. In some cases already on the second day, in others on the third day, rarely later, the goat was unable to rise but remained in sterno-costal position.

Practically all goats continued to feed and to ruminate, and in some cases this continued until death overtook the animals. Occasionally a slight improvement could be noticed in the course of the disease.

Death generally overtook the animal when in the sterno-costal position, in rare cases, however, when in lateral position. In some cases in the course of the disease atrophy of the muscles of the legs and contraction of the flexors were noted. In these cases the legs could not be straightened out.

Goats that recovered showed very much the same symptoms, but less markedly, however. Some animals were able to rise every day for some time, but they had difficulty in doing so; subsequently they went down and were unable to rise. They then gradually improved, until complete recovery had taken place. Others were unable to rise from the beginning, but were able to do so later and then continued to improve. Some animals again, although unable to rise, were able to stand when placed on their feet and to walk about with a stiff gait; subsequently voluntary attempts were made to rise, and finally the animal succeeded. In several recovered animals, especially those that had a prolonged disease, contraction of the flexor muscles had occurred, the animals standing on flexed legs and knuckling over at the carpal joints. Most of the animals continued to feed and ruminate during the course of the disease.

J.—SYMPTOMATOLOGY AND COURSE OF LAMSIEKTE IN SHEEP DRENCHED WITH PYCNOSOMA LARVAE AND PUPAE.

There were seventeen sheep that were drenched with pycnosoma larvae and pupae. As a result of drenching, a number developed pneumonia, of which some animals recovered and some died. It is possible that in these cases lamsiekte was also present. The disease that was noted could be explained as lamsiekte and be described as peracute and acute.

PERACUTE LAMSIEKTE.

There were three sheep (9875, 9874, 8030) in this group. No symptoms were noted on the day previous to death, which occurred during the night. The sheep were found dead next morning. The post-mortem lesions were interpreted as those of lamsiekte.

ACUTE LAMSIEKTE.

There was one sheep (9443) that could be considered to be suffering from acute lamsiekte. The incubation period noted was two days, and the disease lasted one day. When noticed ill the sheep was frequently lying down in sterno-costal position. Subsequently it went over into lateral position, lying stretched out on one side. No further symptoms were recorded.

K.—SYMPTOMATOLOGY AND COURSE OF LAMSIEKTE IN SHEEP INJECTED WITH TOXINS.

There were three sheep that developed the disease, which was of an acute course, lasting from one to two and a half days and ending fatally.

The incubation periods were as follows:—

One and a half day in the case of one day's duration (1); three days in the case of a two and a half days' duration (2); four days in the case of two and a half days' duration (3).

The symptoms in all three cases were almost identical. The sheep when noted ill showed disturbances in the locomotor system. They showed stiff gait and went down often. During the course of the next few hours they became almost completely paralysed. When put on to their feet one managed to stand, but went down as soon as it made an attempt to move. The others became completely paralysed. When lying in sterno-costal position, the head was doubled back. Subsequently they were found down stretched out flat on one side.

L.—DISCUSSION OF THE SYMPTOMATOLOGY AND COURSE OF THE DISEASE IN SHEEP AND GOATS DOSED AND INJECTED WITH TOXIC MATERIAL.

Both sheep and goats proved susceptible to the toxin contained in putrid carcass material. Drenching experiments with carcass material were carried out mainly with sheep, whilst goats were used for the culturally produced toxin. The symptoms observed, without entering into any details, might be considered to be identical with those found in cattle treated in a similar way. There were no records of ours to show that sheep or goats contracted the disease naturally, although reports that such had occurred were received by us from farmers. The identity of the symptoms was particularly remarkable in the case of goats treated with toxin, and the same course of the disease was noted; the identity also referred to the incubation period. There was, however, one difference, viz., the absence of an affection of the masticatory and deglutitive organs in the goats, which was but rarely observed. It might also be mentioned that the goats that showed a long course of disease, or that recovered, had a somewhat longer incubation period, although this period was never a long one and never exceeded eight days. The duration of the illness was even longer than in the case of cattle.

M.—SYMPTOMATOLOGY AND COURSE OF LAMSIEKTE IN HORSES INJECTED WITH TOXIN.

There were thirteen horses injected with toxins. In the cases that received large quantities, the onset and evolution of the disease was more or less rapid, and both the length of the incubation period and the course of the disease stood in a certain relation to the quantity injected.

The acute course with one day's incubation and one day's duration was observed in a horse injected with the largest quantity (11996) viz., 20 c.c. toxin.

The subacute course with one day's incubation and one day's duration was noted in the case of a horse (12963) injected with 5 c.c. toxin. It was killed *in extremis*.

In all other cases the disease was of a more or less chronic nature, sometimes ending with acute symptoms. It resulted after an injection of repeated doses of toxin, that were at times increased and decreased in quantity. The object of the injection was to hyperimmunize the horses in order to obtain an anti-toxic serum. In these cases the incubation periods could not always be clearly determined. The disease resulted either from the accumulative effect of the previous injections, or it was due to the increased quantity of toxin that now corresponded to the minimal pathogenetic dose. The course of the disease varied somewhat in the various horses. In some instances definite symptoms that indicated paralysis of the deglutitive organs developed towards the end of the disease, whilst in others these were absent. In practically all cases the animal lost condition subsequent to toxin injections. Some of these horses recovered from the effects of the toxin, and subsequently resisted a new toxin injection. Paralysis of the locomotor system was not pronounced in every case. Some animals remained on their feet almost up to the time of death. It would appear that they went down from mere weakness. They subsequently became paralysed, so that they were unable to stand when lifted on to their feet.

Symptoms indicating paralysis of the deglutitive organs were seen in several horses, most of which died. The tongue was protruding and could not be withdrawn. A discharge appeared in the nostrils, and the food was regurgitated, thus indicating a paralysis of pharynx or oesophagus.

A symptom not noted in the ruminants but more or less marked in some horses was drooping of the eyelids, ptosis.

Disturbances in the circulatory organs, in the respiratory organs, and changes of the visible mucous membrane were also registered.

ACUTE LAMSIEKTE.

The horse received 20 c.c. of toxin. When noted ill it (11996) looked dull but was still feeding. On the following day symptoms of colic were present, also profuse perspiration. Soon afterwards the animal was down, and when attempting to rise, broke down in the front legs. The conjunctiva was much injected. The pulse rate was increased, being at seventy-two per minute; there were twenty-four respiratory movements. Subsequently the horse was unable to rise.

In this case the tongue was paralysed; when drawn out of the mouth, it remained hanging out. The disease developed after one day's incubation and the horse died after one day's duration of the disease.

SUBACUTE LAMSIEKTE.

The horse (12963) received 5 c.c. toxin. When it was noted ill it showed paralysis of the tongue, which was hanging out and could not be withdrawn. The eyes were half-closed, the eyelids drooping slightly (ptosis); the conjunctiva was highly injected, and ecchymoses were present. The pulse-rate was seventy-two. The symptoms remained the same during the next day. On the third day a purulent discharge was present in the nostrils. The tongue was still hanging out and was much swollen and cold. Subsequently the mucosa of the

tongue became necrotic and peeled off in patches. After local treatment, an improvement became noticeable, in so far that the horse was able to withdraw the tongue. The horse remained on its feet during the course of the disease, but gradually became weaker, and only went down the day it was killed, lying stretched out on one side. Towards the end the temperature was subnormal. The disease appeared after an incubation period of two days and lasted five days.

CHRONIC LAMSIEKTE.

Different types of symptoms and courses of the disease could be distinguished in this group. They stood in a certain relation to the treatment the horses had received. In one lot of horses the treatment consisted of repeated injections of large doses at short intervals. One horse (13330) received two injections of 1 c.c. respectively; and in the other horses (13331, 11440, 13530, 12394) the doses were rapidly increased from 0.5 c.c. to 1, 2, 5, and even 15 c.c. All these horses died subsequently.

In a second lot of horses the treatment consisted of injections of small doses of toxin, increasing slowly and until symptoms appeared, when the quantity of toxin was reduced again. There was one horse (12919) that received thirteen different injections, beginning with 0.001 c.c. and finishing up with 4 c.c. Two days after the last injection an acute disease developed, and the horse died after six days.

There were five horses (11074, 11247, 13202, 11227, 10213) that received as many as twenty and twenty-one injections, extended over six months (3.6.20-25.1.21), beginning with 0.001 c.c. toxin and finishing with 5 c.c. toxin, the latter doses being repeated six times before the injection was discontinued. In some of these horses illness appeared and the quantity of toxin was reduced. None of these five horses died, but none seemed to tolerate the toxin since the injection resulted in loss of weight, which in some cases was very marked. Some of the horses seemed to tolerate the toxin after recovery from illness and improved again in condition.

N.—SYMPTOMS IN THE CASES REPEATEDLY INJECTED THAT FINISHED WITH DEATH.

(1) In the case of the horse that received two injections of 1 c.c. respectively (13330), symptoms were noted after each injection, and the horse died after the second one. The first attack commenced with colic three days after the first injection; from this it recovered during the day. Two days later symptoms of paralysis of the deglutitive apparatus were recorded, the tongue was protruding, and there was a discharge from the nostrils indicating difficulty to swallow. These symptoms lasted for one day, and recovery was thought of, although the animal still had a dull appearance. Three days after the second injection a new attack occurred. This time the animal was unable to walk, standing in the same position all the time. A green discharge from the nostrils indicated the impossibility of deglutition, the food returning through the nostrils. Drooping of the upper eyelids was noticed. This second attack only lasted one day, when the animal died.

(2) In the second case the horse received four injections (13530), the quantity being raised from 0.5 to 1 c.c. and then to 5 and 15 c.c.

The third injection was made seven days after the second one or fifteen days after the first one. During this interval a steady loss of condition became apparent, but no acute symptoms were noticed. These were noted after the third injection, and revealed paralysis of the deglutitive organs, a greenish discharge appearing in the nostrils, the stable floor being soiled with this discharge. Drooping of the upper eyelids was also noted. After one day's illness an improvement was noted, the horse again feeding normally. The fourth injection (15 c.c.) was made five days after the third one. The horse did not show a violent reaction to this. It appeared dull. Two days later it was feeding slowly and then either discontinued to feed or fed but little. The horse showed great weakness and finally lay down, but was able to rise. On the fourth day the animal lay stretched out on one side, entirely paralysed. It was unable to lift the head or to remain in sterno-costal position. Regurgitation of ingesta again occurred, revealing paralysis of the deglutitive organs. In the course of this illness the pulse-rate decreased, and the pulse became hardly perceptible and finally imperceptible. The respiratory movements increased on the day of death, their type being abnormal (complication with pneumonia). There was continual micturition.

(3) In the third case that received four injections of toxin (12394) the horse showed acute symptoms only seven days after the last injection (5 c.c.). It had not lost in condition during the period it was injected previously (17 days), but it appeared to lose condition rapidly after the last injection and became so weak that, two days after the onset of the first illness, it could hardly walk. This loss of condition and weakness rapidly increased and twelve days after the beginning of the illness the horse went down, unwilling to rise, even when assisted. There were, however, periods when it was able to rise by itself, and it was then noted to feed. Subsequently the horse went down again on its side. Preceding death it showed a somewhat prolonged agony. In this case the disease from onset of first symptoms lasted fourteen days.

(4) In the first case of five injections (11440), the symptom noted was considerable loss in condition during the period of the first four injections, the weight dropping from 389 to 311 kilograms in one month. After the fifth injection (10 c.c.) the animal developed a paralysis of the deglutitive organs, regurgitation of ingesta being noted. The horse was dead twenty-four hours later.

(5) In the second case in which the horse received five injections (13331), it lost considerably in weight during the period of the injections. The weight after one month had dropped from 349 to 287 kilograms. Six days after the last injection (5 c.c.) the horse went down and was unable to stand when lifted. After twenty-four hours it was found dead.

In the group in which the horses received a greater number of injections, one died after the thirteenth injection. The last dosis injected amounted to 4 c.c. No loss of weight was noted in this horse during the course of the various injections (one or two months). Three days after the last injection, the horse appeared dull, and was not feeding well. Loss of condition had now become evident. Six days after the last injection, symptoms of paralysis of the deglutitive apparatus became evident, regurgitation of food was present. The

gait became unsteady. The horse remained standing until shortly before death, which occurred about eight days after onset of first acute symptoms.

There were five other cases which could be considered to have recovered from the effects of the toxin injections, or at least not to have suffered very much. These were the horses that received twenty and twenty-one different injections over a period of over six months (11074, 11247, 13202, 11227, 10213).

(1) In the first case (11074) the horse had received eleven consecutive injections, the last being 1 c.c., before loss of condition became apparent.

Its initial weight was 320 kilograms; three days after the last-mentioned injection of 1 c.c. its weight was 335 kilograms. In the course of the next fourteen days it received two more injections (2 c.c. and 4 c.c.), and the injection was then discontinued. About one month later loss of weight was very pronounced, it having dropped to 295 kilograms. Subsequently the weight increased and smaller doses of toxin (2 c.c.) were again injected. The weight increased again (332 kilograms), and the dose was then increased to 5 c.c., when another loss of condition was noted (298 kilograms). After twenty-one injections the horse was discharged.

(2) In the second case (11247) the horse increased in weight (from 400 to 413 kilograms) during the initial period of small injections. Four days after the injections of 4 c.c. toxin, it became visibly ill, appearing dull, restless, and feeding slowly. In the course of the next twenty-four hours symptoms revealing difficulty in deglutition became evident. The horse attempted to swallow; it stretched the head forward, but apparently the act of deglutition was not successful. After another twenty-four hours, a temporary improvement was noted, but it was followed by the same set of symptoms, and furthermore, a discharge from the nostrils was present. The horse remained dull during the course of the subsequent days and lost visibly in condition, the weight dropping to 374 kilograms.

The toxin injections were continued and increased to 5 c.c. at a period when the weight had again increased. Another attack of illness occurred, paralysis of the deglutitive organs being more marked this time, greenish ingesta being regurgitated. The symptoms disappeared again after twenty-four hours. They were followed by a drop in weight to 350 kilograms. After twenty-one injections the horse was discharged from the experiment.

(3) The third horse (13202) behaved somewhat singularly. In the first place there was an increase in weight from 365 to 385 kilograms. Three days after the injection of 4 c.c. toxin the horse appeared dull and was noted to feed very slowly. The horse remained in this condition for a few days, during which a discharge from the nostrils was also recorded. The weight dropped to 335 kilograms. Subsequently the dose of toxin was reduced to 2 c.c., after which the weight increased to 380 kilograms. The dose of toxin was again increased to 5 c.c. and repeated six times, but no further changes were noted. The horse was discharged after twenty injections.

(4) The fourth horse (11227) increased in weight from 370 kilograms to 403 kilograms before the larger quantities of toxin were injected. Three days after the injection of 4 c.c. the horse became ill, appearing dull and standing back from the manger. When feeding,

it did so very slowly; the gait also became unsteady. These symptoms were present for some days. The weight dropped to 349 kilograms. Subsequently the horse improved, notwithstanding repeated injections of 5 c.c. of toxin, which on two occasions, however, had been reduced to 2 c.c. The horse had received twenty-one injections when it was discharged.

(5) The fifth horse (10213) showed very much the same symptoms. The weight increased from 395 to 408 kilograms during the time small quantities of toxin were injected. After the injection of 4 c.c. the horse showed signs of illness. It became dull and showed an unsteady gait. In the course of this illness, the weight went down to 378 kilograms. After improvement, the injections, which were reduced to 2 c.c., were repeated. They were subsequently increased to 5 c.c. The weight increased again to 410 kilograms. The horse had received twenty-one injections when it was discharged.

O.—LAMSIEKTE IN THE DONKEY.

Only one case came under observation. The donkey (13789) received 10 c.c. of toxin subcutaneously. The incubation period was two days, after which the animal appeared dull and refused to feed. These symptoms were observed on the second day. On the third day the animal was down, stretched out on one side and unable to rise. It died twenty-four hours later. The disease thus was of a subacute type and lasted four days.

P.—DISCUSSION OF THE SYMPTOMS AND COURSE OF LAMSIEKTE IN EQUINES.

Horses were mainly used in this case. This was done with the intention of producing an anti-toxic serum. For this reason they were repeatedly injected with toxin, and in the course of these injections the symptoms were recorded. Generally it might be stated that, wherever the quantity was a large one, acute symptoms developed and some of the horses died. These symptoms, *mutatis mutandis*, resembled those in cattle and goats, but in addition, ptosis was also noted, whereas paralysis of the locomotor system was not always present. This was particularly the case, when the dosis was sublethal. In such cases symptoms appeared and disappeared or a general state of marasmus occurred, to which the horses succumbed. The naturally contracted disease was not observed; the horse is not a bone-eater, and, therefore, escapes this disease.

Q.—LAMSIEKTE IN OSTRICHES.

There were seven ostriches that came under consideration. They were treated in different ways. One was drenched with rotten meat and pycnosoma larvae (3); one received rotten crushed bones (2); five were drenched with cultures, the quantity of culture varying from 20 to 250 c.c. The bird that received the lowest quantity, 20 c.c. (1), recovered. All the other birds died.

The course of the disease could be described as acute, subacute, and chronic.

The acute disease was noted in two birds (3, 2). One bird (3) had been drenched with rotten bones and larvae and the other with rotten bones only (2).

The incubation period in the first case was one day; in the second case, four days.

In the first case the disease was ushered in by laboured respiration and restlessness. The bird shifted its weight from one leg to the other, moving head and neck about. The wings were drooping. Subsequently it went down, and refused to rise. When lifted on to its feet it was able to stand, but appeared very weak. On the second day it was found lying with head resting on the ground, and unable to carry it in normal position. It was able to stand with difficulty when lifted, shifting from one leg to the other. After a few minutes it flopped down. The bird died during the subsequent night.

The second bird, when noted ill, appeared rather weak in the legs. It lay down most of the time and rose only when forced. When standing it shifted from one leg to the other. On the second day some improvement seemed to have taken place since the bird rose by itself. Subsequently it lay down again. It died the same night.

SUBACUTE LAMSIEKTE.

Three birds (5, 7, 1) were included in this group. In all three cases the birds were drenched with cultures. In one (5), the disease had an incubation period of one and a half day, the bird dying on the third day. The second one (7) had an incubation period of two days, and the bird died on the fourth day. The third bird (1) had an incubation period of six and a half days. It recovered after four days' illness.

The symptoms noted in the first bird were: Lying down and rising with difficulty, and an unsteady gait. On the second day the bird was still able to rise when forced. On the third day it was unable to do so, only lifting the head a little when disturbed, but being unable to carry it. When lifted on to its feet it was unable to stand. Some improvement seemed to take place subsequently. The bird died during the night.

The second bird was lying down, this being the only symptom present. It only rose when forced to do so, and when on its feet showed great weakness, swaying from side to side, and rocking forwards and backwards. The gait was unsteady and the head was carried low. Subsequently the bird went down, stretching neck and head on the ground. There was difficulty in rising, and several attempts were made before it succeeded. On the second day the bird was unable to rise, but able to stand when lifted. When on its feet, however, it took up an irregular position, crossing the legs or placing one foot on top of the other. In the course of the next two days the symptoms remained the same, but were more aggravated. Finally the bird was unable to rise, and in an attempt to do so, fell on one side. It was unable to stand when put on to its feet. It died during the night.

Recovery from Subacute Lamsiekte.

After an incubation period of six and a half days, the bird went down (1), and had some difficulty in rising. When standing it appeared to be unsteady on its legs. These symptoms remained the same for the next three days. On the fourth day the bird appeared to be normal.

CHRONIC LAMSIEKTE.

There were two cases of this description. One bird (6) sickened after an incubation period of one and a half day, the disease lasting for nineteen days; the second bird sickened after an incubation period of two days, the disease lasting for eighteen days.

Lying down and difficulty to rise were the first symptoms noted in the one bird. When walking it showed an unsteady gait. These symptoms remained during the course of the next two days. Subsequently the bird rose only when forced to do so, and when on its feet it showed marked weakness, wobbling from side to side when walking and experiencing difficulty in keeping its balance; the head and neck were carried low. When standing it was restless, rocking backwards and forwards. After about one week's illness an improvement seemed to take place. The bird was able to rise without difficulty and showed a steadier walk than formerly. This improvement, however, soon passed over. By the following day the bird again had difficulty in rising. These conditions remained very much the same. Finally the bird remained down and was found dead on the morning of the nineteenth day.

The second bird (8), showed similar symptoms in the beginning. Its condition also appeared to improve in the course of the succeeding days, when again signs of weakness appeared, and conditions took a turn for the worse. It died on the eighteenth day.

R.—SYMPTOMATOLOGY OF LAMSIEKTE IN DUCKS FED FORCIBLY WITH ROTTEN FLESH AND PYCNOSOMA LARVAE OR INJECTED WITH TOXIN.

One duck (D. 1) received forcibly 40 c.c. emulsion of rotten flesh and pycnosoma larvae. The case was one of recovery.

After seventeen hours the duck was found almost completely paralysed in its legs. It flopped along with the aid of the wings. The mandible appeared paralysed: it was hanging. Five hours later the paralysis of the bill had disappeared, and the duck could shovel up moist bran with perfect ease. The conditions remained unchanged in the course of the next day, the paralysis of the legs still being present. In the morning of the third day the duck was able to run about. It recovered completely.

In a second case (D. 5) the duck received $\frac{1}{2}$ c.c. filtered toxin per os. About ten hours later it showed paresis of the legs. It was able to walk a few yards and then flopped down. Paralysis of the syrinx also appeared to be present since the voice was husky and feeble. After twenty-four hours the duck was able to walk again, and the voice became stronger. The duck recovered completely.

S.—SYMPTOMATOLOGY OF LAMSIEKTE IN PIGEONS THAT WERE EITHER DOSED WITH PUTRID MATERIAL FROM THE CARCASS OF CATTLE OR WITH PYCNOSOMA LARVAE OR INJECTED WITH TOXIN.

The course of the disease was peracute in the case of one pigeon that had received a subcutaneous injection of 2 c.c. toxin. The bird was found dead two hours later.

One pigeon was forcibly fed with putrid material and a second one with pycnosoma pupae. Both died. The feeding was undertaken on two different dates, and both birds took ill the day after the second feeding. One pigeon, when noted ill, showed clonic spasms of head and neck, which were continually shaken. The bird had some difficulty to maintain its balance when walking, and was unable to fly. In the course of the next day, the bird was noted to droop the wings. These conditions remained the same for the next few days. It died after four days' illness. This then would represent a subacute case. The second bird when found ill showed slightly drooping wings and was unable to fly. It died the same afternoon. This would represent an acute case. The third bird sickened seven days after the second feeding of putrid material. The illness was only a short one, lasting one day, and the bird recovered.

T.—DISCUSSION OF THE SYMPTOMS NOTED IN BIRDS.

Ostriches, ducks, and pigeons had proved to be susceptible to the toxin found in carcass material. The symptoms in all three species of birds showed themselves in more or less an identical manner, mainly paralysis of the locomotor system. In this respect they could be identified with those noted in ruminants and equines.

Naturally contracted lamsiekte did occur in ostriches and ducks, seeing that both were known to eat carrion as well as bones, in the case of the ostrich. Symptoms resembling those described were recorded, hence we might conclude that these symptoms noted under natural conditions were those of lamsiekte, as noted in cattle.

THE PATHOLOGY AND PATHOGENESIS OF LAMSIEKTE.

THE PATHOLOGY OF PERACUTE AND ACUTE LAMSIEKTE.

The majority of lamsiekte cases observed by us must be placed under the headings of "peracute and acute lamsiekte." The reason was that most cases were experimentally produced by direct application of the toxic substances, either per os (drenching of putrid material) or parenterally (by subcutaneous injections of cadaver débris, culture, and toxin).

There was, however, also a number of animals that contracted the disease in the natural way by eating putrid bones supplied to them in troughs or scattered on the ground in a paddock, and there were some animals that contracted it naturally without any experimental interference (naturally contracted cases).

The distinction between peracute and acute lamsiekte from a pathological anatomical point of view was of no advantage, both groups showing practically the same lesions. The distinction, although clinically accepted, was an arbitrary one. Even a distinction of subacute cases was not entirely justified, since the lesions in this type were not at all well marked.

The cadavers that formed the subject of the post-mortem examinations belonged to animals of both sexes. Different ages were also represented. For the experimental production of lamsiekte by means of drenching and injections, naturally a cheaper and usually poorer class of tollies and heifers were used, whilst for the bone-feeding experiments the usual farm cattle were selected, mostly cows and